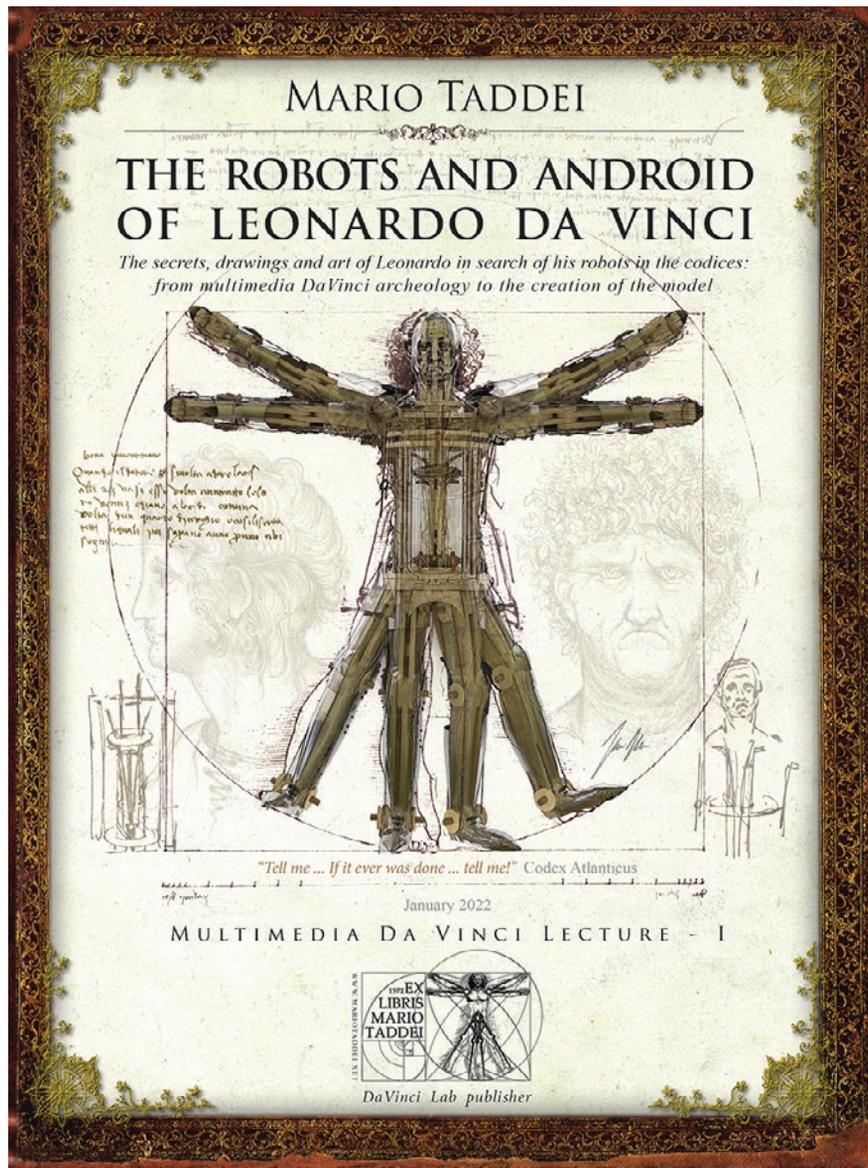


BOOK PREVIEW

ROBOTS AND ANDROID BY LEONARDO DA VINCI

The secrets, drawings and art of Leonardo in search of his robots in the codices:
from The Multimedia DaVinci Archeology to the realization of the model.



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BOOK PREVIEW



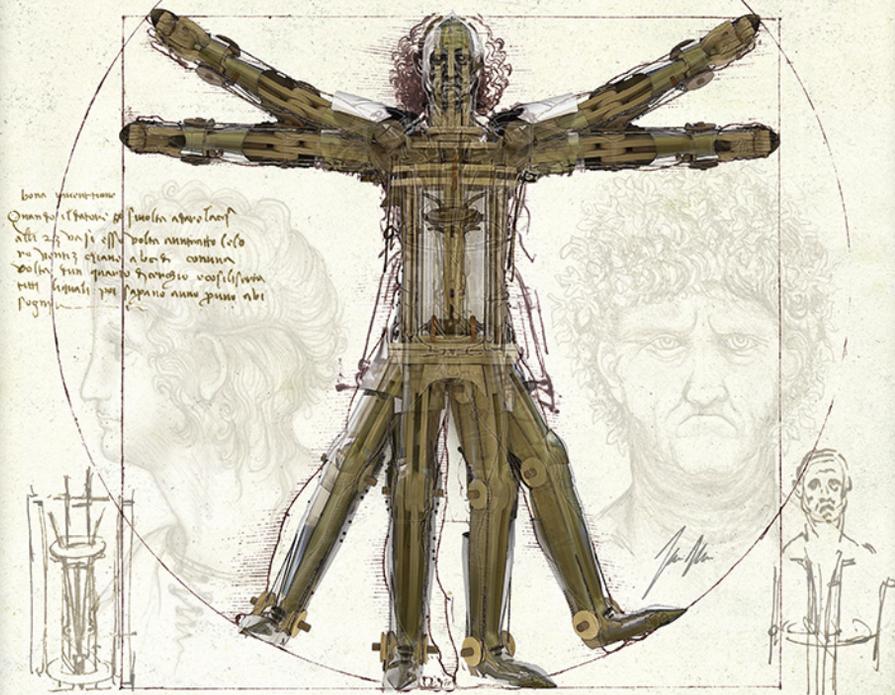
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MARIO TADDEI

THE ROBOTS AND ANDROID OF LEONARDO DA VINCI

*The secrets, drawings and art of Leonardo in search of his robots in the codices:
from multimedia DaVinci archeology to the creation of the model*



"Tell me ... If it ever was done ... tell me!" Codex Atlanticus

January 2022

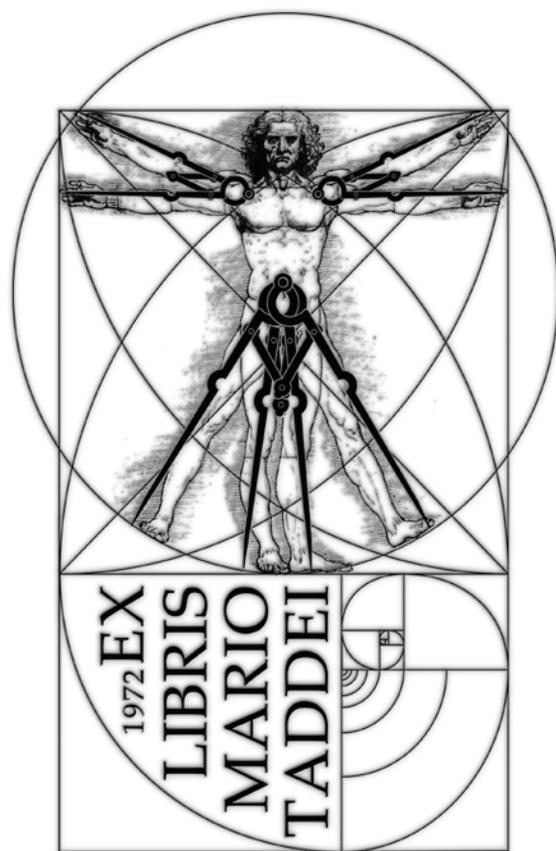
MULTIMEDIA DA VINCI LECTURE - I

LEONARDO DA VINCI WWW

1972 EX
LIBRIS
MARIO
TADDEI



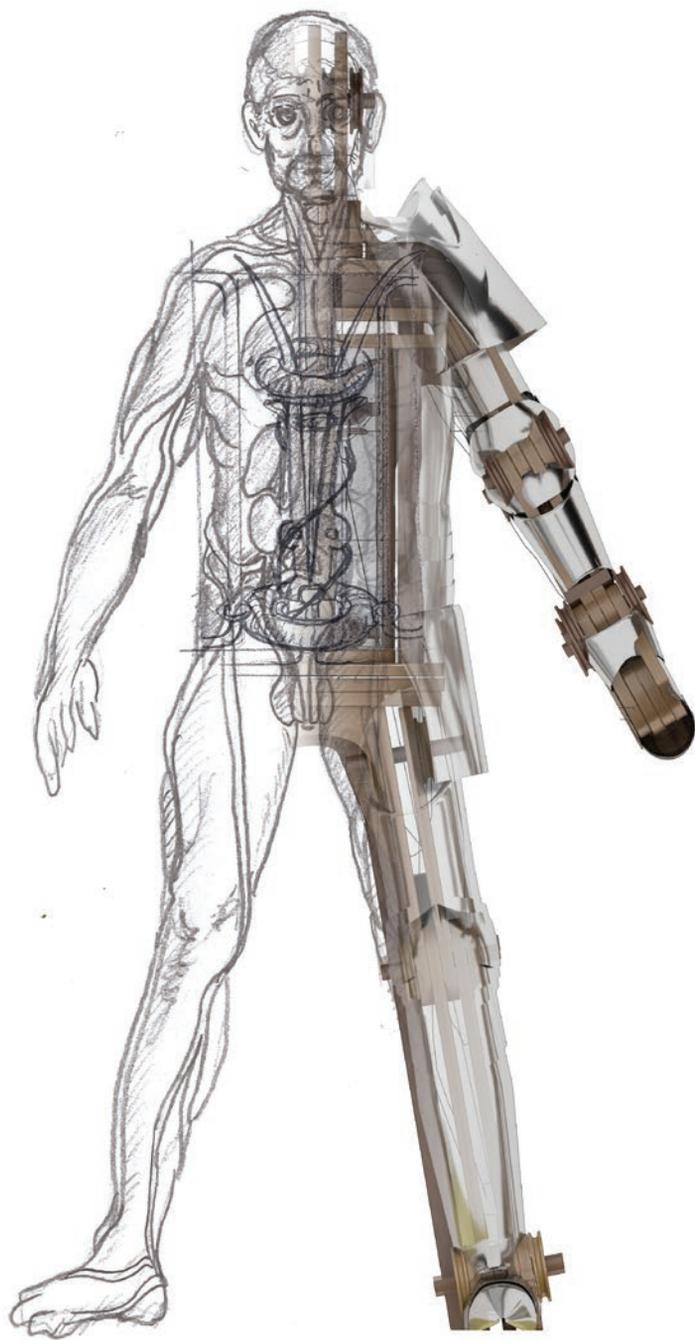
DaVinci Lab publisher

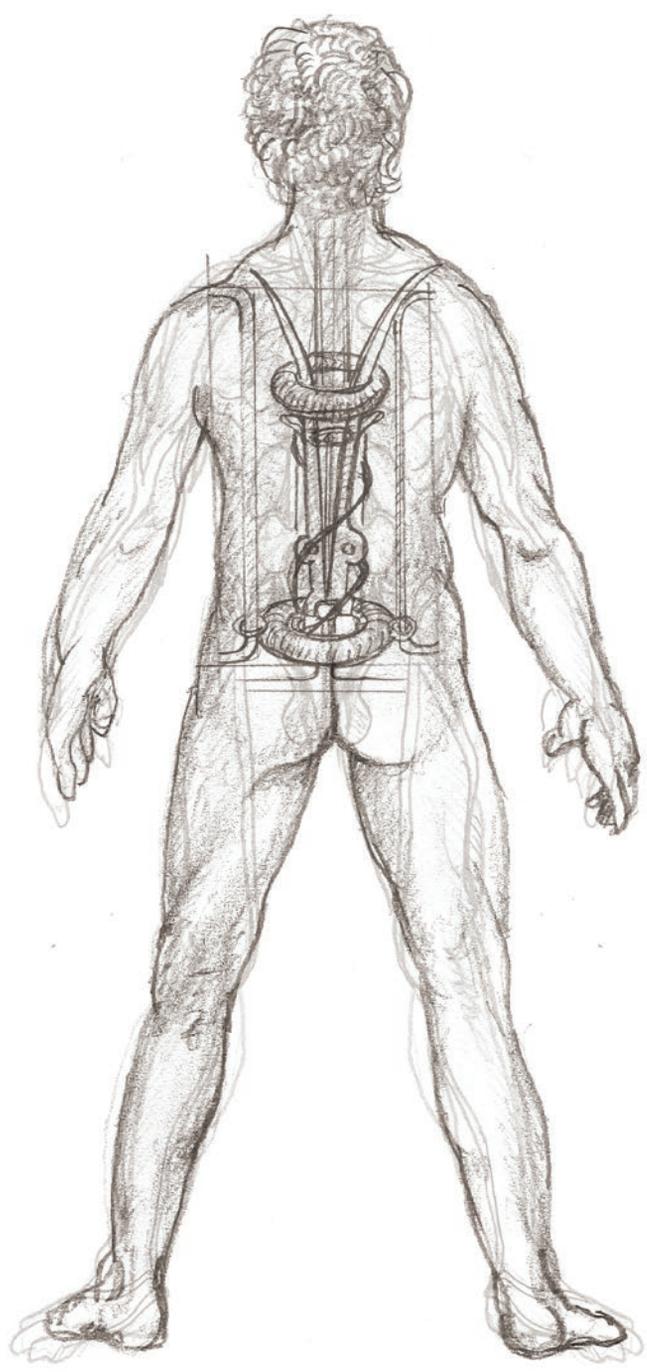




1972 EX LIBRIS MARIO TADDEI

An ex libris, in Latin literally means “from books”, is a label, usually decorated with a motto and a coat of arms, which is applied to a book to indicate its owner. Tradition born in 1400, developed as an artistic symbol by Albrecht Dürer, could be considered the noble relative of the modern logo. The ex libris is full of graphic meanings. Mario Taddei’s main part presents the figure of the man of Vitruvius drawn by Leonardo Da Vinci. The square continues below and displays a succession of rectangles in the golden section. The golden section identifies a spiral that continues and connects with the upper circular arc. Man’s legs and arms are the same compasses, which draw the geometric shapes in which he is inscribed and with which he creates his world. Drawing of a smart matrix drawn by itself:
the architect







ROBOTS AND ANDROID BY LEONARDO DA VINCI

The secrets, drawings and art of Leonardo in search of his robots in the codices:
from The Multimedia DaVinci Archaeology to the realization of the model.

Leonardo da Vinci:

*“When the rope n a will be lowered
in the end, the foot d will have risen
in he. And when the string e reaches
f, the foot d will be lowered “*

Codex Madrid I page 90v

Leonardo da Vinci:

*“ Let the float M have as much
power of weight in descending as its
lightness in rising ... “*

CV Tav 191

Leonardo da Vinci:

*“Tell me ... if it ever was done ...
tell me!”*

Codice Atlantico folio 996v

Android:

An artificial being, a robot, with
human features, present above all
in the science fiction imaginary.

Robot:

Autonomous machine, automaton,
automatic mechanical operator
controlled by a program. From
robota: mechanical “slave”.

Automa:

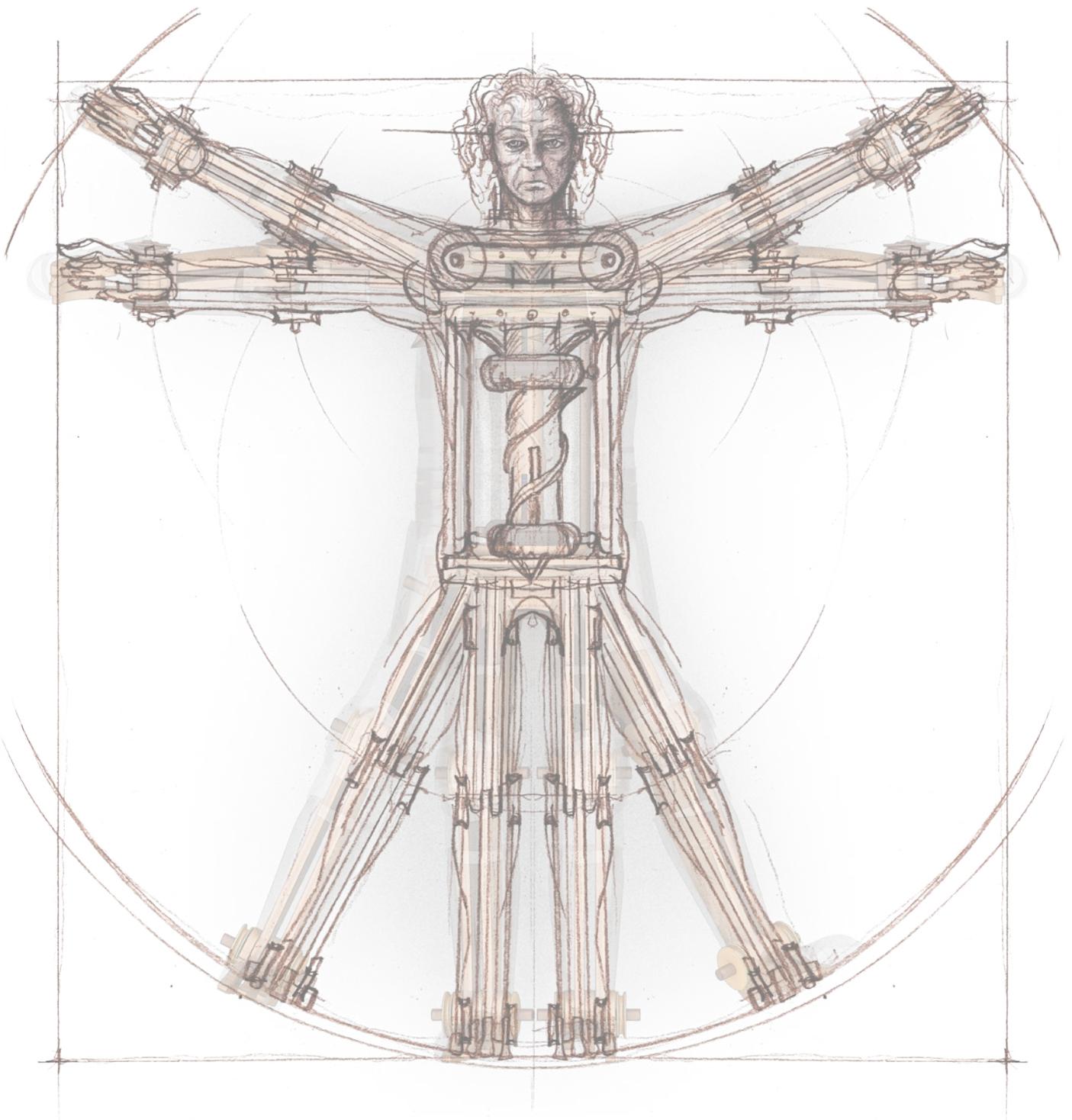
Machine that reproduces the
movements and appearance of
humans and animals.

Clock:

Instrument designed to measure
time intervals that works with
gears moved by a weight; it can
also be solar and water.

Cyborg:

Sci-fi imagery, a being on the
border between man and machine,



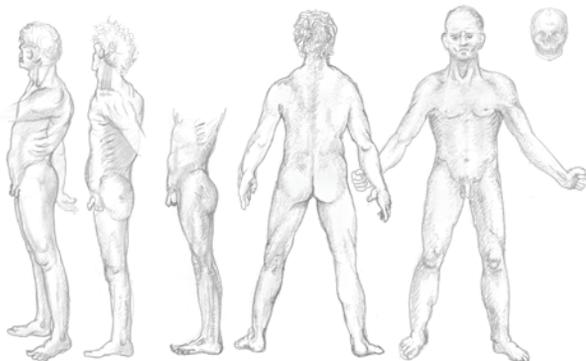


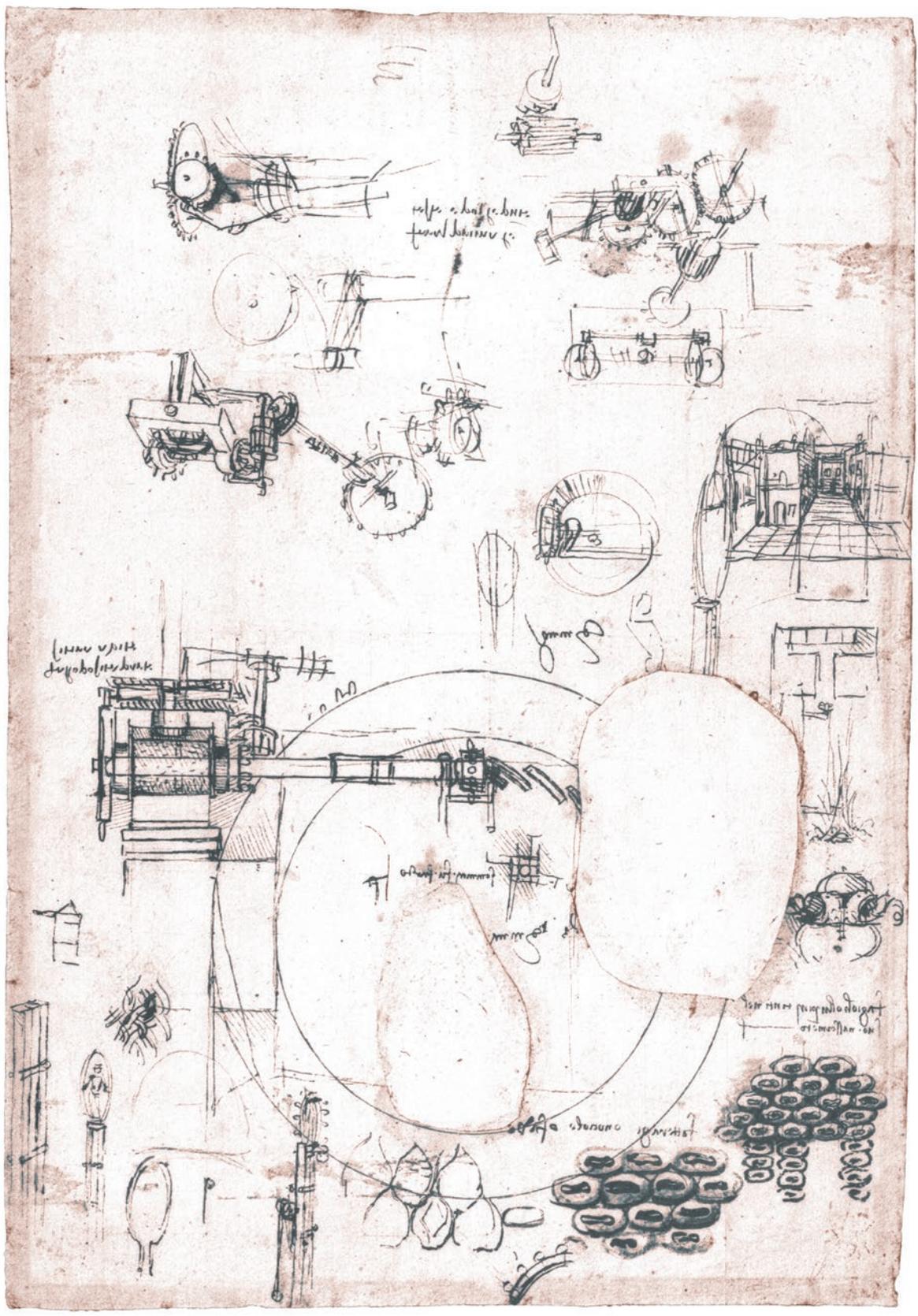
INDEX

1. TELL ME!
2. IF IT WAS DONE, WHAT?
3. MECHANICAL THEATER
4. A ROBOT IN THE CODES
5. A TRIP TO FLORENCE
6. AUTOMOBILE ROBOT
7. A LITTLE ROBOT CAR
8. A ROBOT KNIGHT IN NEY YORK
9. A ROBOT LION
10. A KNIGHT ROBOT
11. MECHANICAL HUG
12. THE CODE OF MECHANICS
13. TABULA RASA
14. ARTIFICIAL FEMUR
15. WATCHES AND ROBOTS
16. ALTERNATE MOTIONS
17. SOLDIER ROBOT
18. MUSICIAN ROBOT
19. CYBORG
20. INSIDE THE EYE
21. ARTIFICIAL EYE
22. CLXXXXI
23. SEARCH FOR CLUES
24. SUBJECT ANALYSIS
25. LOGICAL RECONSTRUCTION
26. HYDRAULIC CYLINDERS



27. 24 HYDRAULIC HOURS
28. HYPERTEXT LINKS
29. RE DRAW
30. ANATOMY AND MECHANICS
31. ARTIFICIAL VOICE?
32. CLOCK PALACE
33. THE HYDRAULIC CYCLE
34. FOUR OR TWO LEVERS?
35. THE DAMA ON THE BACK
36. THE TWO DISAPPEARED DRAGONS
37. LONG LIFE DRESSES
38. THE IVY MAN
39. THE SHUT-OFF VALVES
40. HYPOTHESIS AND COMBINATIONS
41. VITRUVIAN MAN
42. ANDROID PROJECT
43. 3D MODEL
44. MATTERS OF SCALE
45. EXPLODED VIEWS 3D
46. WATER BATTERY
47. SMALL MODEL
48. CREATING MODELS
49. DOES IT WORKS?
50. ~ MARIO TADDEI
51. ~ VIRTUAL EXHIBITION
52. ~ BIBLIOGRAPHY & LINKS
53. ~ DAVINCI MULTIMEDIA LECUTRES





Codex Atlanticus Lincei/Hoeppli DR M.T., page 996v



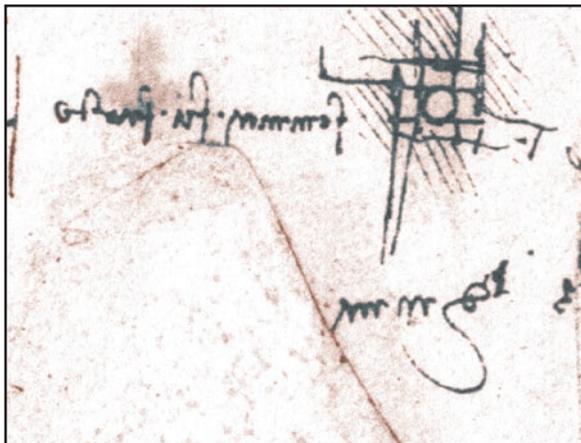
TELL ME!

*“Tell me ... if it ever was done ...
tell me!”*

Codex Atlanticus page 996v

In Leonardo’s manuscripts we often find this strange expression: “Tell me if such a thing was ever done”, they are isolated sentences, sometimes you only find “tell me” or other expressions written in the first person. It is Leonardo himself who writes about his research, if it had ever been done, talks to himself and very often adds personal considerations, notes also on what he will have to do and want to do to improve the research or disseminate it. It is a very personal and particular thing. Leonardo is proud of his work and intends to continue it indefinitely, always curious and always open to new discoveries.

Almost always, in his manuscripts, Leonardo speaks in the first person, and I, Mario Taddei, will also speak in the first person in this text. The research, the dissemination and even the study of manuscripts, for many years was carried out by scholars who quarreled fiercely over the various interpretations, making the same research come alive. By now, this tradition has been lost, giving space to aseptic descriptions reported in all the books on sale, copies of copies that never add new ideas and that publishers re-propose with re-editions that are always the same and, with contents, that no one controls or re-reads anymore. . Research, including that on Leonardo’s manuscripts, must be free and must also be able to question what has already been written and which is present in museums, often dusty and sad, whose administrators now think more about selling cups and pencils and enrich themselves rather than supporting researchers and publishing new books. This is also why I, finally free *, am happy to be able to share my new research, the result of thirty years of experience on Leonardo and the desire to do and discover, the same one that never abandoned Leonardo and that made him great and eternal.



specular

semmai fu fatto

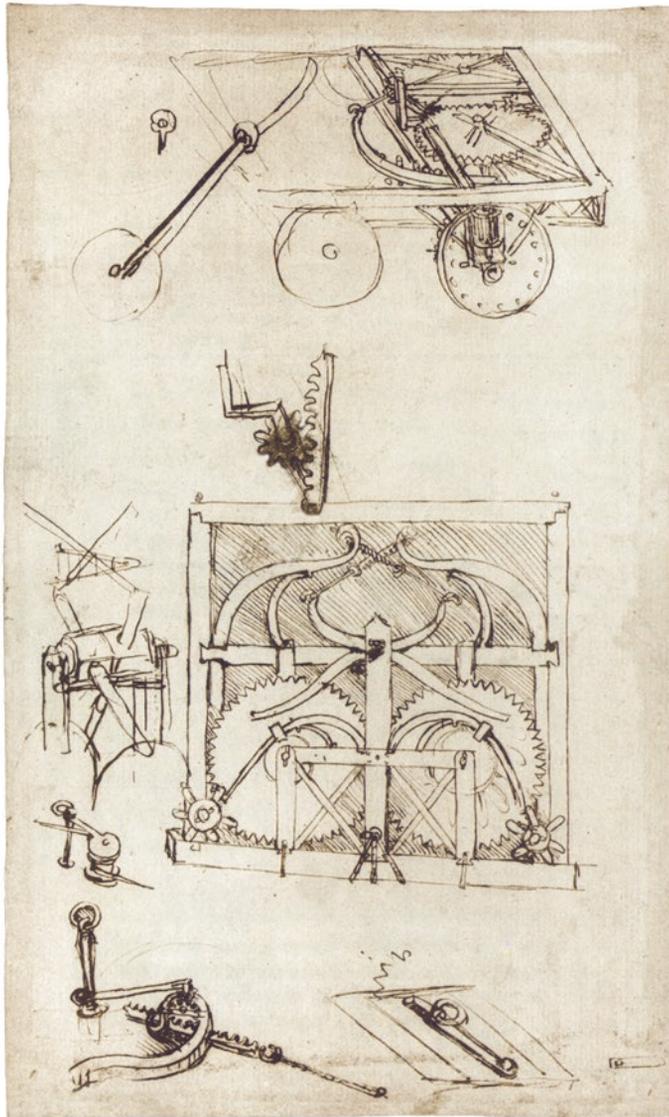
*if anything it was done
semmai fu fatto*

Tell me

Dimmi

A ROBOT IN THE CODES

There is a famous drawing by Leonardo found on folio 812r of the Codex Atlanticus. This subject has been studied for many years and many have wanted to see Leonardo's car in these drawings. Many models have been made, I myself will have made a dozen, now in every Leonardo museum there is a version of this car. The real problem is that the machines built starting from Leonardo's project never worked. But above all it is not clear why Leonardo had to design such a complex car, when a horse and a chariot at his time, 500 years ago, were fast, reliable and easier to use.



Studying the design there were hypotheses that started from the concept of automobile, or mechanical cart, because the drawing, at the top, clearly shows a cart with wheels and a kind of stick / steering wheel. Remember the carts that were built as children, in Italy when there was no internet. I myself, as a child, built carts to launch myself on the slopes of my grandmother, Bovino, and Leonardo's cart looks a lot like us.

This project, however, over the years intrigued many scholars and other hypotheses and models continued to arise, moving the hypothesized function of the subject from a car / cart to a more fascinating robot.

This is where my story, linked to Leonardo's robots, originates from a trip to Florence in 2003, the beginning of an adventure that is worth telling, also to understand how the mysteries of Leonardo not only fascinate every generation but they will never cease to amaze us.



2/6/2003 Paolo Galluzzi, Mario Taddei, Carlo Pedretti, Andrea Bernardoni and ...a PC



A TRIP IN FLORENCE



I asked my Uncle Michele Dota, a famous architect from Florence to arrange an appointment with an acquaintance of his, Professor Galluzzi from the Florence Museum of the History of Science. This “family” date that was supposed to last only a few minutes turned into a nice surprise.

It was June 3, 2003 and, by pure chance, Leonardo’s greatest expert, Carlo Pedretti, was also in the museum that day. The director, Paolo Galluzzi, after seeing my thesis and the machines I had rebuilt, called him. The 5 minutes became hours and Pedretti himself realized that both communication, but above all scientific and historical research, could make use of the powerful computer tools of three-dimensional modeling and animation. From there, even with his friend Andrea Bernardoni, a series of proposals for doing something new immediately started, an exhibition, research and a new way of disseminating science with extensive use of multimedia tools.

Guess where we started from? The curious coincidence was that, recently, an American engineer, Mark Roseim, had just done a Lettura Vinciana, in Vinci right on Leonardo’s cart, advancing with new hypotheses and researches, the discourse on this mysterious device.

Galluzzi’s proposal was, therefore, to study the 512r sheet again and create something new with 3d models. I accepted the challenge and immediately started working on the 3d model of the cart which immediately became Leonardo’s robot. The gears in fact suggested a programming and an autonomous energy source, so not a car, cart but a real robot!



L'Antiquariato ha fatto centro. Una grande iniziativa per ogni appassionato d'Arte e di Antiquariato.

Il Sole 24 ORE DOMENICA

Nei mesi di aprile e maggio, 28 prestigiose gallerie vi aspettano, nel cuore di Milano, per presentarvi le proprie collezioni d'arte e antiquariato.

DOMENICA 18 APRILE 2004 - N. 107

PAGINA 25

IL CLASSICO, INFINITO PRESENTE. DI CARLO ORSOLA



CARLO V IMPERATORE GLOBETROTTER. DI MASSIMO FERRI



IL PIRELLONE E ALTRE VETTE LOMBARDE. DI FELVIO IRACE



MICHELANGELO HA PERSO LA TESTA. DI MARCO CARBINATI

Rivive al Museo della Scienza di Firenze la celebre «automobile» progettata dal genio di Vinci nel 1478. Funziona davvero

SUL BITURBO DI LEONARDO

DI PAOLO GALLUZZI

Al 24 aprile al 5 giugno sarà allestita a Firenze presso l'Istituto e Museo di Storia della Scienza (Piazza dei Giudici 1, tel. 055248311, www.ims.sif.it) la mostra su «L'automobile

di Leonardo», nella quale saranno esposti, tra l'altro, spettacolari modelli del dispositivo ideato da Leonardo. La mostra nasce da un'iniziativa dell'Istituto e Museo fiorentino alla quale ha offerto un

contributo determinante la Banca di Credito Cooperativo di Cambrano nel quadro delle celebrazioni del 120 anni dalla sua fondazione. All'automobile di Leonardo è dedicato anche un espositivo sito

web con funzioni interattive e ricco di modellizzazioni digitali dal 24 aprile: http://francescoel.com.it/laautomobile/index.htm, realizzate dallo Studiòdm di Milano. Abbiamo chiesto a Paolo Galluzzi,

storico della scienza e direttore del museo, di illustrare per il lettore del Sole 24 Ore le novità interattive che hanno permesso di costruire un modello funzionante dell'"automobile" di Leonardo.

Nei mesi di aprile e maggio, 28 prestigiose gallerie vi aspettano, nel cuore di Milano, per presentarvi le proprie collezioni d'arte e antiquariato.

I manoscritti di Leonardo costituiscono un patrimonio inestimabile nel quale capita spesso di scoprire gemme preziose. Da un secolo e mezzo questo gioiello, nel quale le vene si accavallano in maniera talvolta incomprensibile, è stato oggetto delle incursioni di antemurali cacciatori alla ricerca di prede succedute. Nelle loro reti sono cadute alcune delle più mirabolanti invenzioni del genio fiorentino: idee profetiche, visioni o anticipazioni di scoperte per le cui mobilitazioni si sarebbe dovuto attendere dei secoli. Una delle prede più precoci e mai cacciate dei precorrittori vinceschi è stata la cosiddetta "automobile" di Leonardo, un progetto avanzato soprattutto dagli schizzi vergati nel f. 812 del Codice Atlantico, assemblato al 1478. Non sorprende affatto che, all'inizio del Rinascimento, quando sulle strade del pianeta debuttavano gli scoprittori veloci a motore, la scoperta che Leonardo aveva concepito l'automobile addormenta alla fine del Quattrocento suscitasse vivissima sensazione.



Non era un mezzo di trasporto, ma un sofisticato marchingegno destinato a produrre effetti speciali nei festival di corte.

La ricostruzione in modello era opera di Giovanni Casanovi, ingegnere, grande promotore della cultura e dello sport dell'automobilismo, e uno dei Commissari più attivi della mostra milanese. Casanovi aveva dedicato all'automobile di Leonardo uno studio dettagliato, che vide la luce nello stesso anno. Nonostante sottolineasse con enfasi le grandi istituzioni

di Leonardo, Casanovi era convinto che il progetto del f. 812 attestasse un progetto che Leonardo non portò a compimento. Tale convinzione gli consentì di attenuare il rammarico con quale era costretto a riconoscere l'irrimediabilità, «questo veicolo così com'è stata disegnato, non può aver funzionato».

L'analisi conclusiva dipendeva dalla ricostruzione in modello di Giovanni Casanovi, ingegnere, grande promotore della cultura e dello sport dell'automobilismo, e uno dei Commissari più attivi della mostra milanese. Casanovi aveva dedicato all'automobile di Leonardo uno studio dettagliato, che vide la luce nello stesso anno. Nonostante sottolineasse con enfasi le grandi istituzioni

Questa eccezionale anticipazione di Leonardo fu segnalata infatti, già nel 1905, da Giuliano Calvi, uno dei pionieri della moderna filologia vivesiana. Più avanti negli anni (1936) Calvi definirà il progetto come "la Fiat di Leonardo", un'etichetta nella quale si riflette emblematicamente un altro fattore cronologico che contribuisce al cooperare, in quei decenni, l'interesse per i sensazionali precorrittori viveschi. Mi riferisco al marchio che sfruttamento propagandistico (nel quale si diffuse soprattutto il regime fascista) del mito scientifico dell'ispirazione da parte dei vivesiani delle grandi concezioni del "genio scientifico italiano". Leonardo, inventore "universale", divenne l'icona emblematica di quel mito non disinteressato a un "automobile" sarebbe offeso. Il fatto ha bene testimoniato delle similitudini espressionistiche subiti dai grandi miti nazionali, alle quali, in questi anni, veniva finalmente reagito con massima determinazione.

La prima ricostruzione in modello dell'"automobile" vivesiana comparsa infatti nella Sala delle Arti Meccaniche di quella mostra, la legenda che la descriveva nel catalogo sottolineava come nel dispositivo si potessero riconoscere alcuni strumenti precorrittori di sistemi di propulsione a molla, la trasmissione indipendente e il differenziale.

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VADEMECUM
Di fronte ai bochi (ora in Tutti i racconti, Einaudi, Torino 1999) Abraham Yehoshua narra il rapporto tra un vecchio condottiero arabo e un guardabuchi ebreo. L'arabo è faticosamente relegato in una condizione di silenzio, poiché ha la lingua tagliata e comunica con l'ebreo solo attraverso lunghe occhiate, a tratti anche di odio. Privato del proprio nome e del proprio villaggio, su cui gli israeliani hanno fatto costruire una fattoria, il poliziotto riesce infine a incrinare il buco che si era formato, insinuando per prendere coscienza di un legame fittizio ed emulativo con la propria terra. Yehoshua scrive questa novella agli inizi degli anni Sessanta, in un'epoca in cui i nuovi arrivati ai confini del ebraismo provano ansie e delusioni. Forse, se la ristrettezza degli, renderebbero entrambi i protagonisti operatori attenti di un incendio che nessuno sa più spegnere né spegnere.

CONTRAPPUNTO
Se Renzo sceglie l'occhio per occhio
DI RICCARDO CHIABERGE
«E' tornata addosso una pena, nel corso degli anni, in due mesi, su cui gli israeliani hanno fatto costruire una fattoria, il poliziotto riesce infine a incrinare il buco che si era formato, insinuando per prendere coscienza di un legame fittizio ed emulativo con la propria terra. Yehoshua scrive questa novella agli inizi degli anni Sessanta, in un'epoca in cui i nuovi arrivati ai confini del ebraismo provano ansie e delusioni. Forse, se la ristrettezza degli, renderebbero entrambi i protagonisti operatori attenti di un incendio che nessuno sa più spegnere né spegnere.»

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Sua maestà l'imperatrice riceve a corte. 150 anni fa "l'arabo" sposa la sua "sissy". E come le stelle di diamanti che ornano i suoi capelli (e i ricami di questa bella imperatrice italiana ancora per tutta Vienna - soprattutto nel Museo di Sissi che verrà inaugurato il 24 aprile. Godetevi questa particolare "identità"...

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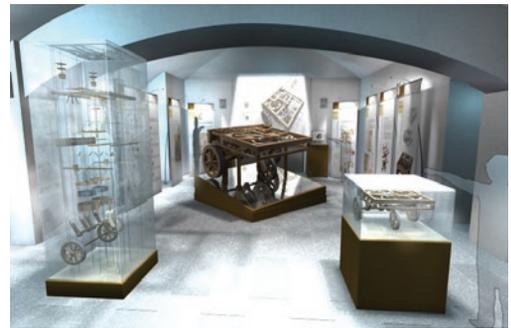
AUTOMOBILE ROBOT

In 2005, we created the exhibition on Leonardo's car in the Museum of the History of Science in Florence. The event was a success, also because, for the first time, the exhibition saw not only the classic printed panels, reproductions and models built in wood, but also 3D views of the exploded machine and understandable and modern graphics.

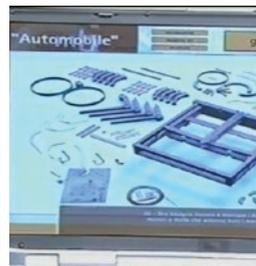
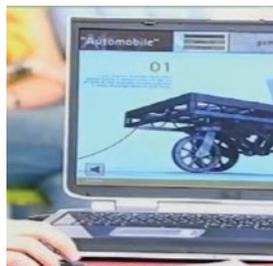
Before the realization of the actual exhibition, I used computer graphics both to design and to visualize the installation, today almost 20 years later I use virtual reality for the exhibition projects but, at the time, it was a real revolution, above all because it was possible to study the set-up directly in 3D.

I made the 3D model of the car starting from Canestrini's studios up to Roshaim's and I made numerous mechanically functioning versions.

The fundamental element, which I always kept in mind, was the continuous feed back with Leonardo's manuscript, to maintain consistency and respect for the original project. In fact, I immediately noticed that almost all the reconstructions were not only different but also differed from some mechanical aspects that in Leonardo were clear to my eyes. An example for all: Leonardo's drawing featured a ring and a skate in the center that no one had ever inserted, in any interpretation. Faced with this clue, I refused to ignore the element and proceed without finding a justified mechanical insertion. From here, my technique of reconstructing Leonardo's machines is also born: all Leonardo's signs must find a place in the project and the mechanisms must speak a precise and universal language: mathematics, geometry and technique. In this way I have managed, over the years, to reconstruct numerous unpublished projects by Leonardo while always remaining tied to the original drawing. Often, I had to interpret and make my personal additions but always in the spirit of Leonardo's "assistant".



For the first time on TV on RaiDue I showed the multimedia software, which I had designed and built, to explain both the reconstruction work and the mechanisms. I think it was the first time on TV that such a thing was seen, at noon, not boring but curious and popular. (<https://www.youtube.com/MarioTaddeiDaVinci>)





2004 Codex Atlanticus TREC Hoepli, Manuscript B and first prototype of Leonardo's car

A LITTLE ROBOT CAR

More than a large machine or an automatic chariot, Leonardo's project, found in the Codex Atlanticus, resembles a small robot. In the end it is a question of two large gears, moved by springs or arcs, which transmit the motion to two or more underlying wheels. There is an ingenious system, with brake, which also serves as a starter and a system of levers to move and pull the ropes. Or maybe not? It was 2004 and, although I had been studying Leonardo da Vinci for many years, what I then studied and discovered in the following twenty years makes me understand how deep and broad the study of machines of art and science that Leonardo touched is.

At that time I had bought, using practically all my money, all the Leonardo codes I could find. There are numerous editions and many books on Leonardo but what is fundamental are the books OF Leonardo, not only ON Leonardo, or the reproduction of his codes. I had personally bought both the reproductions of the Codex Atlanticus deriving from the Hoepli edition of 1800, and the collection of the Vincianacommission which had published all the facsimiles of the manuscripts. An immense wealth of knowledge and beauty, more than 5000 manuscripts to study in detail, I understood that I would never stop studying Leonardo.

So, Leonardo's first working robot was a kind of toy car, a spring-loaded robot. The springs of the propulsion of the machine are not seen in the drawing but, both Carlo Pedretti and other scholars, suggested their use. Indeed, once the 50cm large wooden model was built, it was a surprise to see it work.

From 2003 onwards I continued to study this robot, I made new 3D models and many wooden models, including a small toy prototype. In the evening, at my house, I imagined being able to produce that model as a toy, sell it to the public, and through the images and multimedia software I designed, make it understandable to everyone, especially to the little ones who have the right to learn and become , too, of the young Leonardo da Vinci.

And what about a real robot? Similar to those seen on television as Grendizer or in the cinema in the first historical films such as the "Forbidden Planet" or "Metropolis" up to Asimov? In short, is there a real humanoid robot in Leonardo or not?

For this you have to look in other sheets and manuscripts and there are many to explore ...





"All the News That's Fit to Print"

The New York Times

Late Edition
 Today, early shower, then sunny, mild, high 62. Tonight, mainly clear, patchy fog late, low 45. Tomorrow, ample sunshine, light winds, high 58. Weather map is on Page A22.

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Flights of a Renaissance Mind, Brought to Life

From Weekend Page 25

his robust energy and daring, his scrupulous analysis and care. You turn from a mechanical lion, whose design has been teased out of allusive skeletal drawings in a notebook, to an enormous display on which you leaf through one of the extraordinary codices, page by page, touching the gnomonic text to allow translations and animated machinery to spring from the ink marks. Spend enough time here, and the sensations dazzle: a camel is buoyed by floats to cross a river; a marching musician plays a portable keyboard by knocking a lever with his legs; an ideal city is sketched in tantalizing fragments, including stables in which feed and water for the horses are carefully fed down pipes and waste is washed away through channels in the floor. There is scarcely an aspect of life to which Leonardo didn't apply a fierce intellectual energy.

What would make this show truly spectacular? If the various machines constructed by Leonardo, all said to be working models, could be set in motion with a crank or slow motor. Then we would actually see the way the group's construction of Leonardo's mechanical lion simulated the movements of leg joints, even as the creature crept forward on a wheeled support. Or we would perceive that the screw-shaped flying machine — often referred to as the first helicopter — was actually nothing of the kind, and was more a giant windup toy containing a taut spring that when released would send the screw-sail flying. Or we could watch the ratchets and springs of the "self-propelled cart" magically power the complex mechanism, once used, the exhibition proposes, to simulate magical movement on the theater stage. Of course even if we could see all this, some of the flying machines would not really take off, since, as the show points out, the wingspan of the hand-held wings of one of them would have to stretch more than 50 feet.

I was able to see some motion demonstrated. But visitors will have to rely on the computer-screen simulations. That turns out to be more than sufficient, with only a few exceptions: the children's section leads down a few unclear paths. And the displays created by the group in 2005 to catalog the great Codex Atlanticus (an interactive program that impressed me at the time) now seem almost rudimentary compared with the elaborate on-screen explorations being offered of Leonardo's codex on flight (also available on a CD-ROM) or the scans of another surviving codex known as "Manuscript B."

Somewhere along the way, though, we realize that we are not only being exposed to Leonardo's workshop but also to the mental workshop of Leonardo. And it too is impressive, not least because, as its president and one of its founders, Massimiliano Lisa, explained in an interview, it combines serious research, scholarly ambitions and an impressive publishing program with energetic showmanship and the international touring of exhibitions like this one.

"Leonardo da Vinci's Workshop" is on view through March 14 at Discovery Times Square Exposition, 226 West 44th Street, Manhattan; (866) 987-9692.



"The Last Supper," "Mechanical Lion" and "Robot Soldier" at the exhibition "Leonardo da Vinci's Workshop" at Discovery Times Square Exposition.

ONLINE: SLIDE SHOW
 Additional images from "Leonardo da Vinci's Workshop," at Discovery Times Square Exposition: nytimes.com/design

The casual viewer may not even realize the extent to which the show's creators are active forces in this exhibition, tracing arcs of thought begun by Leonardo.

Mario Taddei, another founder of Leonardo who designed many of the models here (including the lion and the mechanical bat), paid close attention to sketches in Leonardo's notebooks, recognizing connections between, say, a drawing of pulleys and strings and a later diagram of a leg joint.

And by carefully examining the circular rings around one drawing of the "helicopter," and by noting that there is no way that Leonardo would have envisioned that such a turning structure could have lifted the weight of four men (as is often imagined), Mr. Taddei concluded that the rings represent a spring. He redefined the nature of the machine.

Similarly, based on almost painfully brief sketches of a musical instrument, Edoardo Zanon, also a founder of the organization (and creator of the first working version of the self-propelled cart with Mr. Taddei), has been designing the first functional model of a "harp-



Leonardo's "Aerial Screw" is a flying machine powered by a giant spring.

sichord-violin" that will arrive here in late December. It creates tones by using a continuously moving loop of horsehair against which strings are pushed by the notes of a keyboard — a kind of inverse violin, contained in a portable case. Scholars will have to assess these hy-

potheses, as well as others here, including the suggestion that a portrait over-written by Leonardo's notes on flight shows a youthful image of the same aged man in the famous "Self-Portrait" (which may not, the show notes, actually be a self-portrait). The exhibition also

offers touch-screen elucidations of details in that "Self-Portrait," as well as in the Mona Lisa and "The Last Supper."

Such observations can be illuminating, but when a computer simulation also displays what these paintings must have looked like before time, accident and misuse had altered them, I was far less convinced than when encountering simulations of Leonardo's machinery. Line, tint and texture are so radically altered in these "restorations" that Leonardo's work seems to recede into insignificance. The show might also have been more powerful had its final displays of reproductions of Leonardo's drawings offered even a minute sampling of the originals that graced the exhibition at the Metropolitan Museum a few years ago. All of which is to say that the aesthetic realm has a different order of precision than the mechanical.

But it isn't for aesthetic revelation that this show should be seen. Working through it slowly, with admiration for the creator and his insightful disciples, we begin to sense the texture of Leonardo's mind, the way his drawings of a horse's leg might lead to abstract depictions of levers and pulleys. And we see how his exquisite attention to a woman's smile could lead to sensations of spiritual flight that he would try to replicate in the physical realm, his machines promising to soar into the heavens.

A KNIGHT ROBOT IN NEW YORK

Five years after the exhibition on Leonardo's robot car in Florence, I presented my new studies on Leonardo's robots, the robot lion and the robot knight in New York

On the morning of November 19, 2009 the exhibition was ready, I had worked for a week day and night arranging my manuscripts of the Royal VincianaCommission in the display cases, assembling the helicopter, the mechanical bat, the mechanical lion, the robot knight and many multimedia software that I had planned and dreamed of since 1999. A dream came true, a great and new exhibition on Leonardo with models and things never seen before.

The organizers were all agitated because the word had spread that shortly after one of the most important and feared journalists of the New York Times would arrive and perhaps he would have crushed with his terrible articles yet another exhibition in the center of New York, next door. in Times Square. I was not worried and was just waiting to be able to explain my work in detail. The "terrible" Edward Rothstein arrived, and it was immediately freezing. It sounded like a Woody Allen movie, the snow outside in New York, a freshly edited show and the bad reporter who had crushed everyone on Broadway. After talking to the other organizers, it was my turn and, the five minutes he devoted to everyone, became 2 intense hours in which, for the first time, I found an intelligent and curious journalist, who really wanted to understand things and not limit himself to copy press releases, as everyone does now.

Was my robot lion Leonardo's? And was the robot soldier really a working Leonardo project? In reality, these two projects derive from Leonardo's notes and ideas to which I have given my own interpretation. Respectively, the projects derive from the Madrid Code and from sheet 579r of the Atlantic Code.

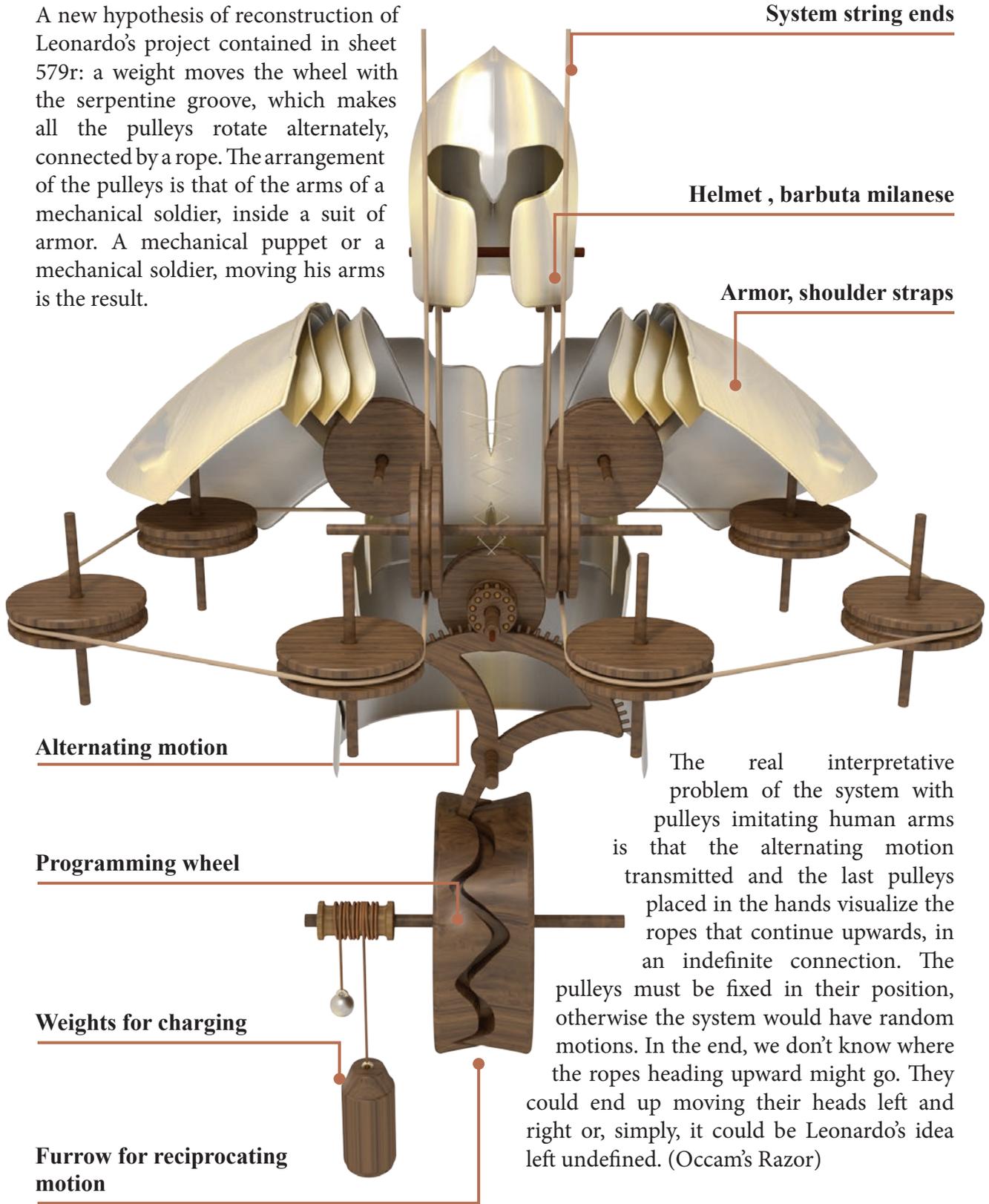
The new research, published in my book on robots released in 2007, however, presented a new approach to research on Leonardo. I had not limited myself to observing and interpreting a drawing or a single sheet in the Leonardo codes but I had found the clues scattered in several sheets that, according to the logic of space and time, had to be sequenced, to get an idea of Leonardo's projects. In short, what I call, Multimedia VincianaArcheology.



Discovery Channel - November 2009 "Leonardo da Vinci's secrets"



A new hypothesis of reconstruction of Leonardo's project contained in sheet 579r: a weight moves the wheel with the serpentine groove, which makes all the pulleys rotate alternately, connected by a rope. The arrangement of the pulleys is that of the arms of a mechanical soldier, inside a suit of armor. A mechanical puppet or a mechanical soldier, moving his arms is the result.



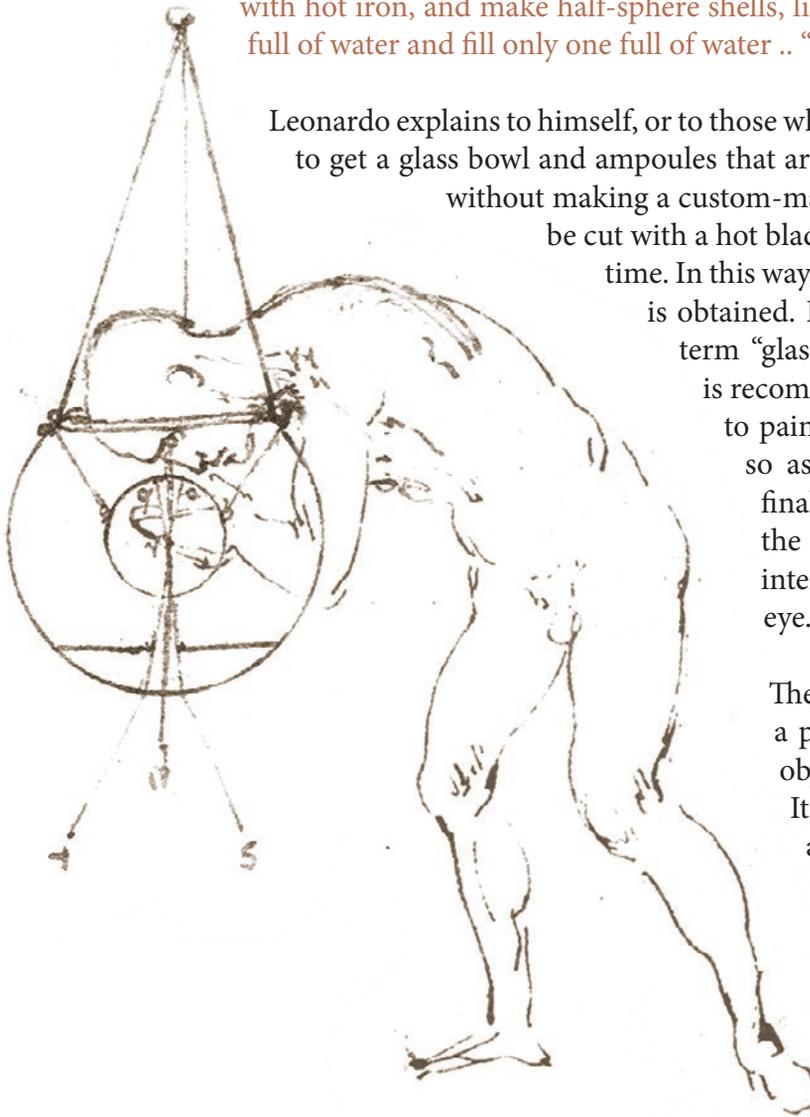
The real interpretative problem of the system with pulleys imitating human arms is that the alternating motion transmitted and the last pulleys placed in the hands visualize the ropes that continue upwards, in an indefinite connection. The pulleys must be fixed in their position, otherwise the system would have random motions. In the end, we don't know where the ropes heading upward might go. They could end up moving their heads left and right or, simply, it could be Leonardo's idea left undefined. (Occam's Razor)

ARTIFICIAL EYE

“..Break a glass bowl and the convexity and concavity will make you a flat water mask and you will see what promises to be true underneath ..”

In the pages of the manuscript on the eye, Leonardo explains how he intends to do this vision experiment inside an enlarged artificial eye. And he not only describes the experiment from a theoretical point of view but goes on to tell how to make the model in the laboratory.

“..Makes spherical cruetes like this, and then you cut them as you cut screw glasses with hot iron, and make half-sphere shells, like this, and then make your glasses full of water and fill only one full of water ..”



Leonardo explains to himself, or to those who want to carry out the experiment, to get a glass bowl and ampoules that are already “on the market”, therefore without making a custom-made glass object. The glass cruet can be cut with a hot blade, just like glasses were made at the time. In this way, the object that will be the container is obtained. In his descriptions he also uses the term “glasses”, like half-sphere glass shells. It is recommended to use hot water inside and to paint the external wall of the ampoule, so as not to let the light through. The final effect is that of being able to see the underlying object reflected in the internal sphere, as if we were inside our eye.

The device has only a scientific and not a practical purpose, it is a fascinating object: a real artificial eye.

It looks like a virtual helmet, which allows you to see what would otherwise be impossible to observe.



Vinciana Library, ancient editions, codices, reproductions, facsimiles and reconstructions

CLXXXI

In an ancient and rare edition of Leonardo's manuscripts, the Royal Vinciana Collection, there is a booklet (the 5th) that collects many drawings of portraits, plants and architecture. This historic edition of 1928, collected Leonardo's manuscripts scattered in various collections all over the world and tried to organize, by themes, the drawings by Leonardo scattered everywhere. While the codices were real bound books, almost two thousand other Leonardo manuscripts were, on the other hand, single sheets collected in various collections. The most famous is the Codex Atlanticus (actually not a codex but a collection of sheets). Among these tables is 191, in Roman numerals: CLXXXI, our "smoking gun". In 1939 (MCMXXXIX) this description of the contents of the sheet was given:



“CLXXXI.

Studies of a chemical problem with various tubes inside a container and also a screw press inside it: geometric figures, a virile bust, a sketch of an ivy-covered dress for a theatrical performance, another sketch of the same dress with skirt and sleeves but with the sole indication of the ivy branches without the foliage. Near the first dress the words: ivy is of long life.

Windsor, Bibl. R. n. 12282v.

In pen on yellowed white paper. A. o, 36o L o, 270. “

The numbers of the codices are many, however, today this sheet is part of the anatomy collection archived in various ways. 12282v is one of his names, “v” stands for “verso” as the front and back of the same sheet. So it is also useful to then analyze the “recto”, the other side of the sheet, cataloged in the collection as CLXXXII (192).



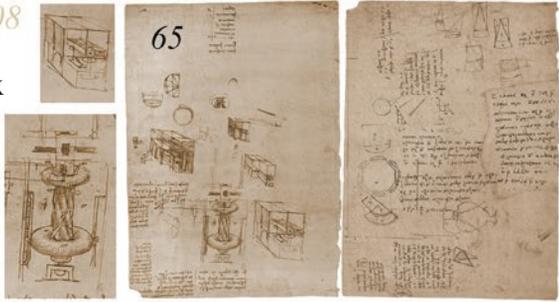
CLXXXII.

Study of a profile of an ephebe; shield with dragons tied around two sticks arranged in an X shape; hanging lamp with ribbons at the shop; lighted faci that radiate out from the lamp; a plow, which reads: do not go out of the furrow; a plow on whose tip a spatula iron falls, and under the words: inexpedience does not bend me every inpedimeto is destroyed by rigor; a compass on which the sun flashes, and underneath it is written: he who is fixed does not turn round; a sketch of ivy braiding for an actor's dress, as in the previous table. Also apart, another small study for the weaving weaves can be seen in pencil.

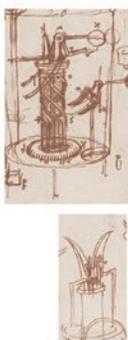
Windsor, Bibl. R., n. 12282r. In pen on yellowed white paper. A. 0.370; L. 0.280. “



1508
24 hour clock



1508



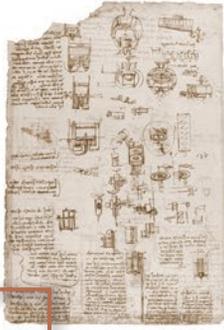
943



fountains



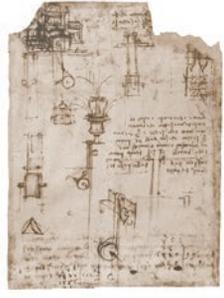
782r



1508



975



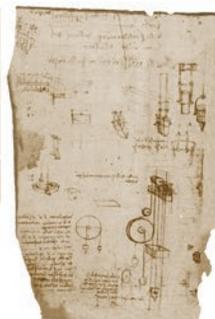
1011

508

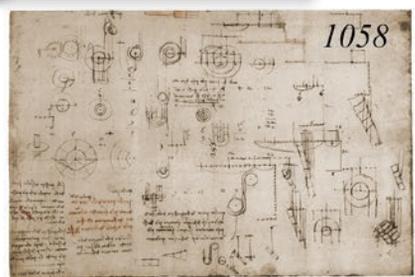
hydraulics



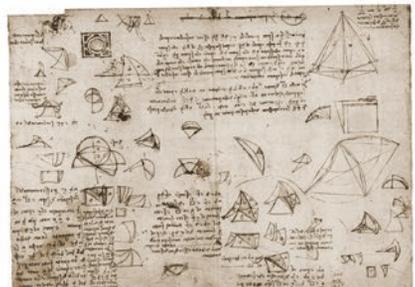
961



783



1058



1508

Research connections between manuscripts - water clock group and automata



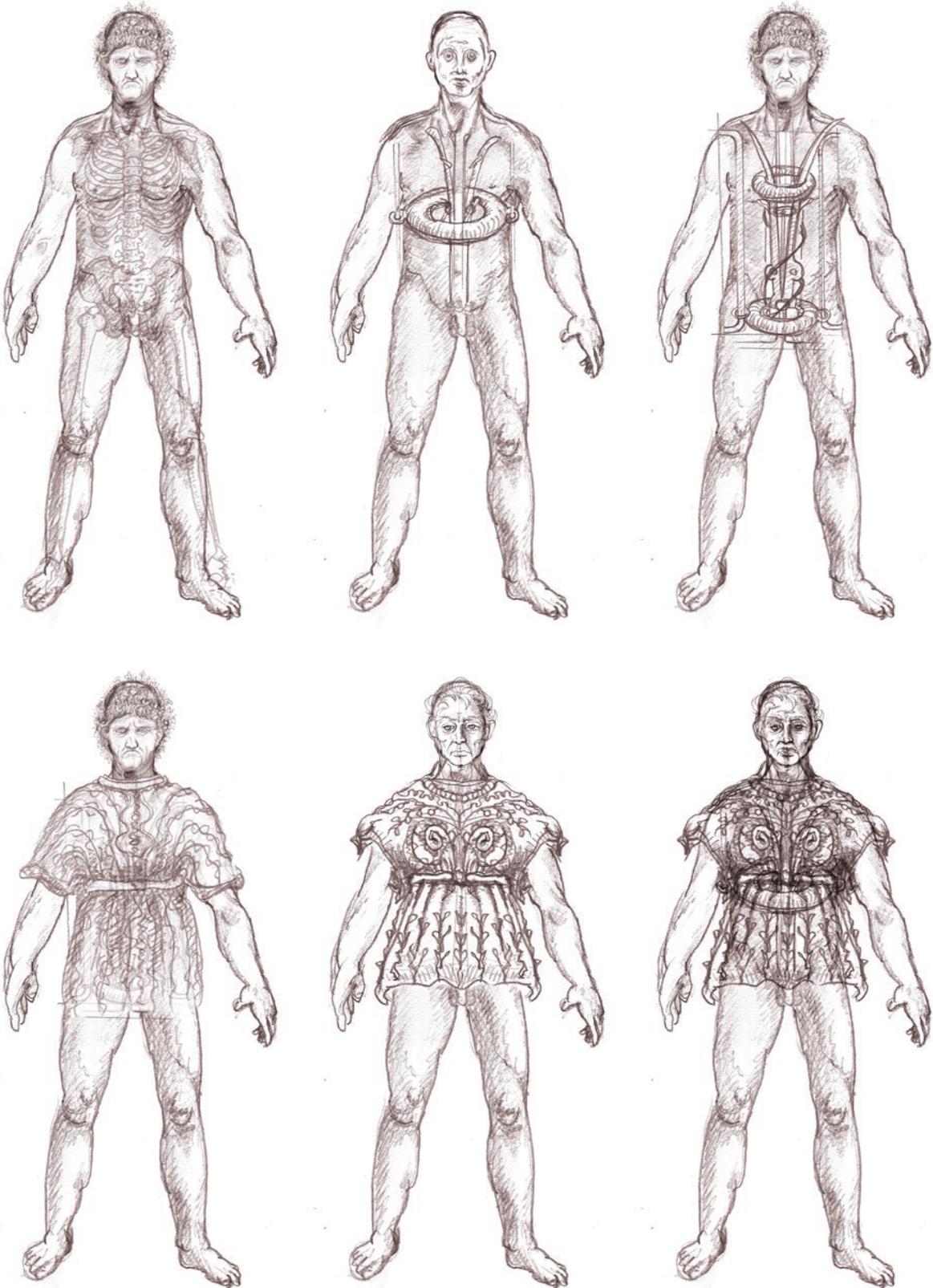
RE DRAW

One technique for understanding Leonardo's drawings and his projects is to "copy" his drawings. It seems strange, but the fastest way to study and understand projects and machines is taught by Leonardo himself. As a young man, in Verrocchio's workshop, Leonardo drew all day to refine the technique and understand the art. And to do this, he copied other drawings, works, drapes, dresses and flowers. Drawing is not only used to artistically represent subjects but, in industrial design, it is essential to represent machines, especially the most complex ones. Copying Leonardo's machines is more difficult than copying faces or artistic subjects, because to copy the machines and mechanisms you must first understand them.

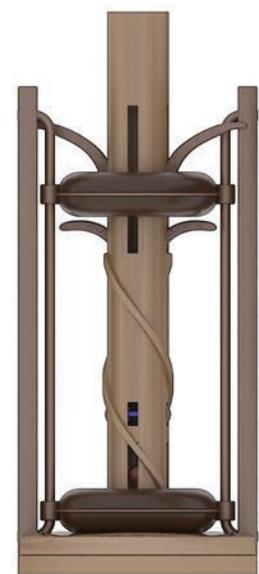
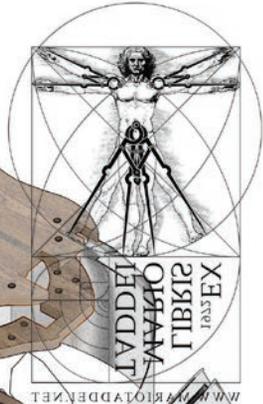
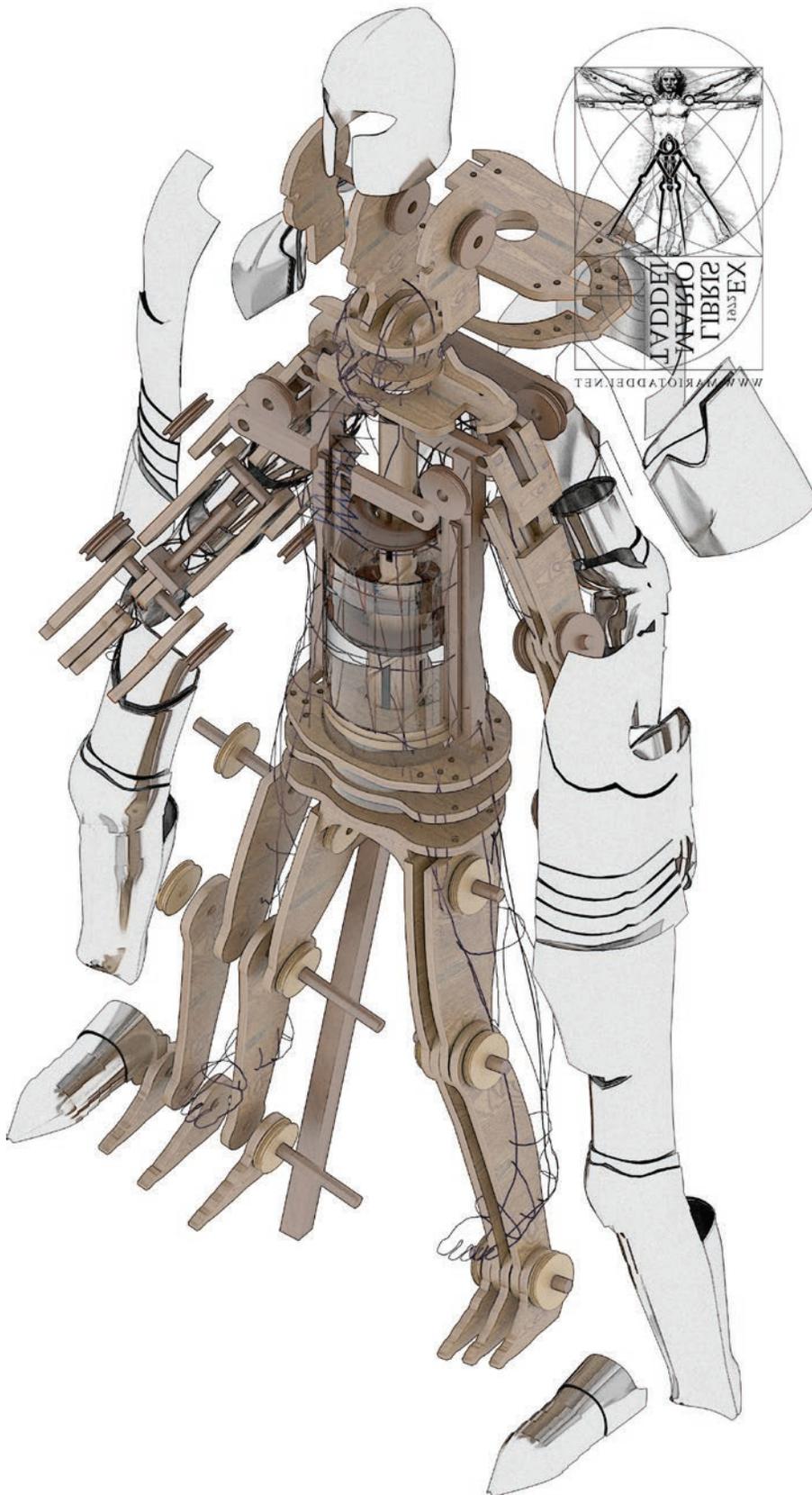
That's why, one of my favorite research techniques is that of freehand drawing. The only way to truly understand Leonardo's machines is to do the same thing he did, to draw them. That is why for this research, as for all the ones I have done so far, I have used some time to draw. Once Leonardo's drawings have been copied and understood, they can be completed, improved and interpreted. The same design for this book was first drawn. Leonardo himself teaches us that drawing is also a research and study tool.

These drawings are subsequently transferred with the scanner, to the computer in digital format and, here, it can be very helpful to use digital tools to duplicate, enlarge, rotate and combine the subjects and to complete the drawings digitally. The next step is to use 3D computer graphics, starting from these drawings, to create the 3D models of the subjects and then build them from life in the laboratory.





Reconstruction hypothesis - combinations deriving from drawings by Leonardo da Vinci



Technical drawings and exploded view of the android

WATER BATTERY

I made a first series of 1: 4 scale models, compared to real human dimensions. The first piece to check is the “engine”, the central clockwork device. Built in small dimensions, it allows to study and verify the functioning of the mechanisms.

Theory is one thing, practice is another. Leonardo himself theorized and proposed practice as a teacher of knowledge. Projects on paper and then in 3D are always beautiful, magical and apparently functional, then, in practice, you realize how things work differently.

This is the case, for example, of this device, which, on paper, seems to work, then unfortunately not in practice. In making the model I, in fact, realized that the biggest problem lies in the geometry of the release tabs, located inside the cylinder. It is already very difficult to make two work, if then, as in other drawings by Leonardo they become four, it is impossible. I have verified that they cannot function properly because the sticks are interfering with each other. This is why Leonardo himself kept drawing many different versions. In fact, it is very difficult to find the right geometry for their operation.

However, the finished device looks just like a water “battery”, its purpose is to exploit a flow of water to transform it into a rotational, programmed and cyclical movement.





android, 1: 1 scale model, floating ring

CREATING MODELS

Creating models is important. It is not enough to imagine or design a project to think that it is perfect and functional. Even if precise digital modelers are used, the behavior of the materials is always unpredictable. Wood, iron, ropes and all other materials do not have ideal shapes and behaviors. The 3D pieces, made on the computer, are “ideal”, precise and immutable. Wood, on the other hand, bends and expands, even if it is cut precisely, depending on the type, humidity and grain it is certain that it will change shape. Iron is more stable but difficult to work. The ropes, canvas and leather, then, are elastic materials, there is no way to create a precise shape or length that will remain the same once the piece is assembled. All this information is understood only after having assembled the pieces of a real model. Depending on the behavior of the materials, the friction and the shape change, the 3D model will have to be modified accordingly.

It is very likely that Leonardo himself created some of his study models. This can be understood from his written considerations and from the way in which, at times, he modifies projects. Leonardo himself said that practice is a teacher of life.

Since I was little, I have been making models and I believe that practice is essential to study Leonardo. I don't think it's possible to understand his projects if you don't realize them with your own hands. Many scholars limit themselves to passing Leonardo's drawings to carpenters, luthiers or model makers, then presenting the result as their own work, more than sad this is a practice that Leonardo himself would despise. Working with wood and making models is not only essential for understanding and explaining them but it is what Leonardo himself teaches us as a practice to become his “assistant”.



android, 1: 4 scale model, and pieces for that 1: 1



android, 1: 1 scale model and 1: 4 scale



android, 1: 4 scale model



Leonardo Taddei - android, 1: 1 scale model - Alessandro Taddei



MARIO TADDEI

Graduated in industrial design, Mario Taddei taught at the Milan Polytechnic. He has dedicated a large part of his activity to the study and development of interactive multimedia products for the dissemination of edutainment science. He has been involved in the study and research of Leonardo da Vinci since 1999 and has become one of the leading international experts. Italian academic, he created Leonardo3 in 1999, then technical director and chief researcher of the Leonardo3 Study Center. He has designed and built complex multimedia and scientific dissemination systems for museums, an expert in Renaissance codes and machines. History of science expert. He has signed some discoveries and researches of world resonance on Leonardo's machines. He is an expert in programming, 3D graphics, video games, virtual reality development and multimedia applications.

During the event for the 150th anniversary of the Politecnico di Milano he received the CULTURE award: "Minds Shaping the World welcomes Mario Taddei among its members for the scientific rigor and extraordinary dissemination capacity that allowed him to make unpublished discoveries relating to Leonardo da Vinci and spread them all over the world. Mario Taddei is considered today one of the leading international experts of the genius from Vinci: his exhibitions, performances and installations have been presented over the years with enormous success both in Italy and abroad (Germany, USA, Canada, Mexico, Brazil, Qatar, Japan)."



He has published numerous books around the world on Leonardo's works and machines, drawing manuals, digital art and NFT. His researches and works on Leonardo are visible in museums, itinerant exhibitions and in Piazza Scala in Milan.

He is a digital artist and a designer of cultural events. Professor at the Leonardo da Vinci art academy in Milan. He teaches design, virtual set design and multimedia marketing.

He became the first curator and designer of multimedia virtual exhibitions in the era of the metaverse by collaborating with Lieu.City in 2021.

www.MarioTaddei.net
& www.Neoart3.net



BIBLIOGRAPHY



I robot di Leonardo. La meccanica e i nuovi automi nei codici svelati-Da Vinci's robots. New mechanics and new automata found in codices. Mario Taddei
Leonardo3 – 2007 – ISBN 13: 9788860480088

I Robot di Leonardo. L'automobile di Leonardo Da Vinci
Mario Taddei - Leonardo3 – 2007 – EAN: 9788860480095



Il codice Atlantico interattivo
Mario Taddei, Zanon - Leonardo3, 2005, ISBN: 8860480019



Leonardo, l'acqua e il Rinascimento
Mario Taddei, Andrea Bernardoni, Zanon

I manoscritti di Leonardo da Vinci
Gerolamo Calvi - Augusto Marinoni - Bramante

De L'anatomie, Roux & Viarengo 1901
Codice del Volo, T. Sabachnikoff del 1893
Codice Atlantico Hoepli - 1894-1904
I Codici di Leonardo da Vinci, collezione
Reale Commissione Vinciana - 1929



International:

Secret Note of Leonardo da Vinci – 다빈치의 비밀노트
다빈치의 비밀노트 레오나르도 다빈치의 천재성의 비밀을 밝혀주는 100
가지 이야기! 발행사항 서울: 자유문고, 2017 – ISBN : 9788970301150

Leonardo's Lost Robots
Mark Elling Rosheim - Springer - ISBN: 9783540284970

Il Codice Atlantico
Augusto Marinoni, Carlo Pedretti - Giunti ISBN: 9788809018105



圖解達文西天才發明 – 達文西的天才發明【全彩圖解紀念版】 Mario Taddei
ISBN 9789577768827

Leonardo's Machines. Secrets and Inventions in the Da Vinci Codices, USA
Mario Taddei - Domenico Laurenza, Zanon. - Giunti – 2005 – EAN: 9788809043633

The Last Supper. Secrets, techniques and errors of a masterpiece as never seen before
Mario Taddei - L3 – ISBN: 978-88-6048-017-0



Машины Леонардо да Винчи. Тайны и изобретения в рукописях ученого
Mario Taddei - ISBN: 5-366-00093-2

ダ・ヴィンチが發明したロボット
2009, ISBN 978-4576090771 Mario Taddei

& LINKS



Archives and museums with works by Leonardo:

Digital archive of the history of science
<https://www.leonardodigitale.com>

Codice Atlantico on-line
<http://www.codex-atlanticus.it>



Institute and Museum of the History of Science
<https://www.museogalileo.it>



Veneranda Biblioteca Ambrosiana
<https://www.ambrosiana.it>



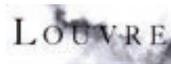
The National Gallery, London
<https://www.nationalgallery.org.uk>



Pinacoteca Vaticana, Roma, Italia
<https://www.museivaticani.va>



National Library of Madrid, Spain
<http://www.bne.es>



Louvre Museum, Paris
<https://www.louvre.fr>

Leonardo's library & lettere vinciane
<http://www.bibliotecaleonardiana.it>

Mario Taddei

<https://www.mariotaddei.net/>

Youtube <https://www.youtube.com/user/MarioTaddeiDaVinci>

Facebook <https://www.facebook.com/Mario.Taddei.1972>

Linkedin <https://www.linkedin.com/in/mariotaddei/>

Pages dedicated to the book with insights, videos and links to the exhibition <https://www.mariotaddei.net/robot-android/>





collection of Multimedia DaVinci Lectures

MULTIMEDIA DA VINCI LECTURES

This series, conceived and edited by Mario Taddei, collects research, studies and reconstructions on subjects related to Leonardo da Vinci. The aim is the pure research and dissemination of Leonardo's art, science, technology and research through in-depth studies on manuscripts, three-dimensional reconstructions, graphic schemes with new digital multimedia languages up to the Metaverse-Leonardo. The homage and the reference is directed to the historic Vinciane Lectures. Just as the historic Vinciane Lectures propose the reading and academic study of Leonardo's texts, the Multimedia ones offer the "three-dimensional and multimedia" reading of the projects, drawings and art of the greatest genius of all time. The publications contain links and connection codes to view videos and web insights. The codes inside also allow access to virtual exhibitions dedicated to Leonardo da Vinci, displayed on simple screens or, even, in virtual reality. Some contents will be available in augmented reality: by framing the pages of the book with a smartphone or tablet, it will be possible to view 3D models as if they were holograms floating on the book. What are the historic Vinciane Lectures?



Lecture Vinciane / DaVinci - Vinciane Lectures

(reference: <http://www.bibliotecaleonardiana.it>)

"Every year, around mid-April, the city of Vinci remembers the birth of Leonardo with the Leonardian Celebrations, events that have their most significant moment in the Lettura Vinciana. In fact, since 1960, the Leonardian Library has entrusted one of the most significant exponents of Vincianahistoriography with the task of a critical intervention on one of the many fields in which Leonardo's activity developed. The continuity of this initiative and the recognized scientific authoritativeness of the speakers (of which we could not cite a few names without doing the others a disservice) have made this event an event of great cultural interest, capable of documenting fundamental trends and main protagonists of Leonardo's studies in the recent decades. The words with which Augusto Marinoni, an illustrious scholar of Leonardo, opened the I Lettura Vinciana in 1960, certainly evoke the intent that guided the birth of the Readings in an evocative way:

The initiative we are about to implement, and which we hope will continue to be renewed from year to year, would like to be a reading essay that, while aiming to illuminate a single page of Leonardo, is able to grasp the ramifications and developments through all his writings. of his thought so as to disperse, if possible, the shadows, the ambiguities in which the isolated fragment often envelops itself as in a halo that above all fascinates those who love to grasp the pretexts of their own fantasies. Augusto Marinoni, The Being of Nothingness, I Lettura Vinciana, April 24, 1960 "



THE ROBOTS AND THE ANDROID OF LEONARDO DA VINCI

*The secrets, drawings and art of Leonardo in search of his robots in the codes:
from Multimedia Vincian Archeology to the creation of the model.*

January 2022 - DaVinci Labs Editore

Original documents and paintings:
Copyright 1452-1518 - Leonardo da Vinci

Works, texts, images, reconstructions and photos:
Copyright 1999-2022 - Mario Taddei

The images and paintings are original elaborations digitally curated in order
to represent the works as they were in Leonardo's time.

The manuscripts and historical documents derive from Mario Taddei's personal library.

Some other images are taken from the web.

The drawings and all the reconstructions are by Mario Taddei



Sources:

De Anatomie, Roux & Viarengo 1901
Codex of Flight, T. Sabachnikoff of 1893,
Codex Atlanticus Hoepli of 1894-1904,
Codes, Royal Vincentian Commission 1929
Various original private reconstructions of the Codes.
NFT & Copyright: 1999/2022 Mario Taddei

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Thanks to:

*Alessandro Taddei, for help in the laboratory in the construction of the robot
Leonardo Taddei, for help in the laboratory in the construction of the robot
Stefano Armeni, for installing Ikea shelves, fries with mayonnaise .. resin and armor. Vinci cats Sole and
Polpetta, true friends and trusted nocturnal assistants.*

*Note: like Leonardo da Vinci, Taddei is also dyslexic, he is appreciated
reporting any errors or suggestions for improving this volume.*

MULTIMEDIA DA VINCI LECTURE - I

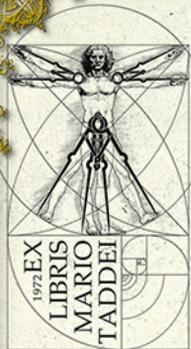
THE ROBOTS AND ANDROID OF LEONARDO DA VINCI

*"Tell me ... If it ever was done ..." What?
Leonardo da Vinci, Codex Atlanticus 996v*

"There is a mystery to be solved in the sheets of the Vinciana collection! In plate 192 there are dozens of apparently confused and incomprehensible devices and drawings, but we recognize a small drawing of a human face that continues in the bust with strange mechanical devices. What is it about? Leonardo studies these devices by dividing clues and hypotheses in many manuscripts. In this sheet, however, a mechanism is associated with a human bust for

which it is possible to hypothesize and reconstruct, for the first time, a clockwork android by Leonardo da Vinci. **The first robot in history? A Cyborg?** We will find out through the analysis of documents, their reconstruction in space and time, with 3D images and graphics"

By studying Leonardo's lesser-known codes it is still possible to discover new ideas and new projects such as that of a water clockwork system connected to a human bust, a real mechanical android. The android / robot was studied and built both in 3D and in the laboratory. In the book you will find the steps and photographs of the construction and a special hypertext link, with a code, which will allow access to additional documents, 360° virtual videos in the laboratory and exclusive access to the virtual exhibition on the Android Robot!
www.mariotaddei.net/robot-android
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